Sheel Bansal

Research Ecologist, U.S. Geological Survey
Northern Prairie Wildlife Research Center
Jamestown, North Dakota, USA
https://profile.usgs.gov/sbansal

Education

Idaho State University Pocatello, Idaho, USA
PhD, Plant Physiological Ecology Dec 2008
Dissertation: The Role of Carbon Balance during Seedling Establishment of Conifer Trees at Timberline
Advisor: Dr. Matthew Germino

University of Pennsylvania Philadelphia, Pennsylvania, USA
MA, Conservation Biology 2000
Thesis title: Biological and Anthropogenic Impacts of the Valdez Oil Spill on Intertidal Communities
Advisors: Drs. Brenda Casper and Daniel Janzen
BA, Biology 1999

Research Experiences

U.S. Geological Survey Jamestown, North Dakota, USA
Northern Prairie Wildlife Research Center
Research Ecologist October 2015 – present

- I am examining changes in greenhouse gas emissions and carbon sequestration in the Prairie Pothole Region that occur with climate change and land use.

USDA-Forest Service, Pacific Northwest Research Station Olympia, Washington, USA
Olympia Forest Science Laboratory
Postdoctoral Research Ecologist Aug 2013 – Sept 2015

- I have analyzed, published and presented data on drought resistance, cold hardiness, productivity and survival of forest crop species in the Pacific Northwest.
- I used genecology, spatial modeling and GIS to identify populations that are better adapted to cope with future climate conditions and to evaluate the potential impacts of assisted migration as a management strategy.
- I designed and implemented a climate change/provenance study to access how intra-specific populations from differing native climates vary in their ecophysiological and phenological response to warmer winters.
- I am collaborating on a study examining root phenology as a function of winter environment.
- I analyzed and presented data on the impacts of planting distances on stand level growth, yield and mortality from a 35-year study.
- Set goals, developed protocols and established timelines for two permanent technicians, one intern and a number of short-term volunteers.
- Co-authored USDA grant applications.
- Oral and poster presentations at multiple conferences.

- Invited seminar speaker at four local community colleges on the effects of climate change on Pacific Northwest ecosystems.

USDA-Agricultural Research Service Burns, Oregon, USA
Eastern Oregon Agricultural Research Center
Postdoctoral Research Ecologist July 2011 – July2013

- I designed and implemented a landscape-scale field study in sagebrush steppe that measured 100 plant community and organism-level traits, soil physical, chemical and biological properties, climate/weather and disturbance variables.
- I modeled relationships among community and ecosystem properties to determine the primary driver of invasive and native plant abundance in sagebrush-steppe ecosystems.
- I analyzed and published data examining the effects of plant litter removal on soil nitrogen mineralization and community dynamics in sagebrush-steppe communities.
- I conducted a study to investigate how precipitation variability (drought-pulse) and soil properties affects the performance of three invasive species.
- I analyzed data comparing traits of invasive and native species to understand interspecific variation in plant traits and performance.
- Set goals, developed protocols and established timelines for two permanent and directly supervised two temporary technicians.
- Co-authored two National Institute of Food and Agriculture Rangeland grant proposals.
- Presented data at international conferences.

Swedish University of Agricultural Sciences Umeå, Sweden
Department of Forest Ecology and Management
Postdoctoral researcher Jun 2009 – May 2011

- I conducted a study on the effects of prescribed burning on seedling performance, gas exchange and soil properties in high and low light environments to understand interactive effects of disturbances.
- I conducted a study to evaluated plant growth and gas exchange following drought and herbivory.
- I compared the ecophysiology of trees, shrubs and mosses along a soil fertility gradient to explain changes in ecosystem productivity and functioning.
- I established and conducted a study on the effects of plant chemical defense compounds on soil respiration.
- I evaluated how temperature and light affects nitrogen-fixation by feather mosses.
- Set goals, developed protocols and established timelines for three permanent and two temporary field technicians.
- Co-supervised a PhD student.
- Co-authored grant proposals for research funding, equipment, and travel.
- Presented data at New Phytologist conference.

Idaho State University Pocatello, Idaho, USA
Graduate Researcher Jan 2009 – Jun 2009
PhD Student Aug 2004 – Dec 2008

PhD: My research study determined relative changes in seedling carbon balance along elevation gradients across the treeline boundary to understand limitations on establishment at high elevations.

- I conducted study on the effects of simulated climate change on plant establishment at high elevations.

- I established protocols to measure physio-morphological traits on understory vegetation.
- I acquired laboratory equipment, maintained inventory of chemicals, and established protocols for biochemical analyses of plant tissues.
- Directed undergraduate students to collect field data and prepare laboratory samples.
- Trained undergraduate students to perform nonstructural carbohydrate analysis on plant samples.

Publications

Scan or http://unitedstatesgeologicalsurvey.academia.edu/SheelBansal for abstracts

Bansal S, St. Clair BL, Harrington CA and Gould PJ. 2015. Climate change impact on conifer cold hardiness: Environmental and genetic consideration. *Global Change Biology* 21:3814-3826 doi: 10.1111/gcb.12958

Bansal S, Harrington CA, Gould PJ, St. Clair BL. 2015. Climate-related genetic variation in drought-resistance of Douglas-fir. *Global Change Biology* 21:947-958.

Jonsson M, Kardol P, Gundale M, **Bansal S**, Nilsson MC, Metcalfe D and Wardle D. 2015. Direct and indirect drivers of moss community structure, function and associated microfauna across a successional gradient. *Ecosystems* 18:154-169.

Banal S. The interactive effects of drought and herbivory on ecophysiology of trees. Ed. R. Mahalingam. In: Combined Stresses in Plants. Springer. New York. Dec. 2015

Bansal S, Jochum T, Wardle DA and Nilsson MC. 2014. Interactive effects of burn severity and canopy cover on ecophysiology of tree seedlings in boreal forests. *Canadian Journal of Forest Research* 44:1032-1044.

Bansal S, Sheley RL, Blank B and Vasquez E. 2014. Plant litter effects on soil nutrient availability and vegetation dynamics: Changes that occur when annual grasses invade shrub-steppe communities. *Plant Ecology* 215:367-378.

Bansal S, James JJ and Sheley RL. 2014. The effects of precipitation and soil type on three invasive annual grasses in the western United States. *Journal of Arid Environments* 104:38-42.

Bansal S, Hallsby G, Löfvenius M, and Nilsson MC. 2013. Synergistic, additive and antagonistic impacts of drought and herbivory on *Pinus sylvestris*: Leaf, tissue and whole plant responses and recovery. *Tree Physiology* 33:451-463. Cover photo.

Bansal S, Nilsson MC, and Wardle DA. 2012. Response of photosynthetic carbon gain to ecosystem retrogression of vascular plants and mosses in the boreal forest. *Oecologia* 169:661-672.

Wardle DA, Jonsson M, **Bansal S**, Bardgett RD, Gundale MJ, and Metcalfe DB. 2012. Linking vegetation change, carbon sequestration and biodiversity: insights from island ecosystems in a long-

term natural experiment. *Journal of Ecology* 100:16-30 (Centennial issue). Selected by Faculty of 1000 as in the top 2% of published articles.

Gundale MJ, Nilsson M, **Bansal S**, and Jäderlund A. 2012. The interactive effects of temperature and light on biological nitrogen fixation in boreal forests. *New Phytologist* 194:453-63.

Bansal S, Reinhardt K, Germino MJ. 2011. Linking carbon balance to establishment patterns: comparison of whitebark pine and Engelmann spruce seedlings along an herb cover exposure gradient at treeline. *Plant Ecology* 212:219-228.

Bansal S and Germino MJ. 2010. Unique responses of respiration, growth and non-structural carbohydrate storage in sink tissue of conifer seedlings to an elevation gradient at timberline. *Environmental and Experimental Botany* 69:313-319.

Bansal S and Germino MJ. 2010. Variation in ecophysiological properties among conifers at an ecotonal boundary: comparison of establishing seedlings and established adults at timberline. *Journal of Vegetation Science* 21:133–142.

Bansal S and Germino MJ. 2009. Temporal variation of nonstructural carbohydrates in montane conifers: similarities and differences among developmental stages, species, and environmental conditions. *Tree Physiology* 29:559–568.

Bansal S and Germino MJ. 2008. Carbon balance of conifer seedlings at timberline: relative changes in uptake, storage, and utilization. *Oecologia* 158:217–227.

Publications in Review

Bansal S and Sheley RL. Climate, soil, and biotic relationships in sagebrush steppe: drivers of annual grass invasion. In review, *Oecologia*.

Bansal S, St. Clair BL, Harrington CA. Plant adaptation to climate extremes: A case study with Douglas-fir drought and cold hardiness. In review, *Functional Ecology*

Fernelius KJ, Madsen MD, Roundy BA, Hopkins BG, Anderson VJ and **Bansal S**. Post-fire interactions between soil water repellency, islands of fertility, and *Bromus tectorum* invasibility. In review, *Plant Ecology*.

Curtis, B, **Bansal S**, Harrington CA. The impacts of spacing on tree growth, mortality and tree crown development. In review, Pacific Northwest Research Station Report.

Publications in Progress

Bansal S, Harrington CA, Ford, K. The impacts of warmer winters on growth and phenology of Douglas-fir.

Ford KR, Harrington CA, Gould PJ, St. Clair JB, **Bansal S**. The impact of climate change on phenology of primary and secondary growth.

James JJ**, Bansal S**, Sheley RL and Jones T. Functional trait that drive interspecific variation: Comparison of invasive and native species populations.

Fernelius K, Madsen M and **Bansal S**. The effects of soil hydrophobicity on soil moisture, invasive and native grass seedling establishment and nitrogen cycling after fire.

Bansal S, Stanton S, Monleon V. Oregon Forest Resources: Forest Inventory and Analysis 2001-2010.

Bansal S, Stanton S, Gray A. Washing Forest Resources: Forest Inventory and Analysis 2001-2010.

Conferences

Bansal S, Harrington CA, St. Clair BL. Convergence and divergence of tolerance to multiple stressors along climate gradients. Ecological Society of America. August 2015, Baltimore, MD USA

St. Clair BL, **Bansal S**, Gould PJ, Harrington CA. Geographic variation in adaptive traits in Douglas-fir and responses to climate change. Ecological Society of America. August 2015, Baltimore, MD USA

Bansal S, Harrington CA, St. Clair BL. Finding plants adapted to climate extremes. Drought and cold hardiness. International Association of Landscape Ecology. July 2015, Portland, OR USA

Ford KF, **Bansal S**, Harrington CA, St. Clair BL, Gould PJ. Combing greenhouse and field data to predict the timing of primary and secondary growth of Douglas-fir. IALE. July 2015, Portland, OR, USA

Bansal S, Harrington CA, Curtis. The impact of spacing on tree and stand development. Society of American Foresters – The Wildlife Society, April 2015, Great Mounds, WA USA

Bansal S, Sheley, RL. Annual grass invasion in sagebrush-steppe: The relative importance of climate, soil properties, biotic interactions and disturbance. Northwest Scientific Asso, April 2015, WA USA

Northwest Forest Soils Council Winter Meeting, March 2015, Hood River, OR USA

Growth and Modelers Users Group Annual Meeting, January 2015, Vancouver, WA USA

Region 6 Annual Silviculture Meeting, November 2014, Medford, OR USA

Bansal S, Sheley RL. Linking climate to annual grass invasion in sagebrush steppe of eastern Oregon. Pacific Northwest Climate Science Conference, September 2014, Seattle, WA USA

Bansal S, Harrington CA. Climate-associated genetic clines in drought tolerance of *Pseudotsuga menziesii*. Plant Biology, July 2014, Portland, OR USA

Bansal S, Harrington C, Gould P, St. Clair B. Genetic and environmental effects on drought tolerance of *Pseudotsuga menziesii*. International Association of Landscape Ecology, May 2014, Anchorage, AK

4th Pacific Northwest Climate Science Conference, September 2013, Portland, OR, USA

Bansal S, Jochum T, Wardle D, and Nilsson MC. 2012. Interactive effects of burn severity and canopy cover on ecophysiology of tree seedlings in boreal forests. Ecological Society of America, Portland OR USA

Sheley R and **Bansal S**. 2012. The role of plant litter on nutrient mineralization and vegetation dynamics in three sage-steppe communities with differing levels of annual grass invasion. Ecological Society of America, Portland, OR USA

Bansal S, Germino MJ, and Nilsson MC. 2010. Respiration is more sensitive than photosynthesis in tree seedlings at high altitude and latitude. New Phytologist Respiration Symposium, Oxford, UK

Germino MJ, **Bansal S**, Kelley T, and Reinhardt K. 2009. Climate effects on tree seedling establishment at alpine timberline: experimental evidence for effects of temperature and winter and summer precipitation. Ecological Society of America, Albuquerque, NM USA

Bansal S and Germino MJ. 2007. Elevation and temperature effects on carbon balance near alpine-treeline: comparison of a treeline and non-treeline tree species. American Geophysical Union, San Francisco, CA USA

Bansal S and Germino MJ. 2007. Carbon balance of conifer seedlings at high elevations: comparison of a treeline and non-treeline species. Ecological Society of America, San Jose, CA USA

Bansal S and Germino MJ. 2006. Carbon balance of conifer seedlings across an elevation gradient at alpine treeline. Ecological Society of America, Memphis, TN USA

Teaching and public communication experience

Invited Seminar Speaker Olympia, Washington, USA

Climate, climate change and the impacts on forests of the Pacific Northwest

- Tacoma Community College Apr 2014
- Evergreen Community College March 2014
- South Puget Sound Community College Dec 2013
- Centralia College Nov 2013

Swedish University of Agricultural Sciences Umeå, Sweden

PhD co-supervisor Jun 2009 – Present

- Co-supervisor of a PhD student (Till Jochum, expected graduation Dec. 2015)

Idaho State University Pocatello, Idaho, USA

Teaching Assistant, General Ecology fall semester 2008

Teaching Assistant, Plant Physiological Ecology, General Ecology fall semester 2004

Highland High School Pocatello, Idaho, USA

National Science Foundation Graduate Fellowship 2005-2006

Grant Proposals

Smithsonian Tropical Research Institute 2015

Title: Cambial Growth and Phenology of understory tree species

USDA Forest Service Science Findings 2015

Title: Drought Now and Drought in the Future: What's Going to Happen to Our Forests and How Can We Help?

Awarded $10,000 USD

USDA Forest Service Research Area Emphasis 2014

Early Career Grant (lead Project Director)

Climate change

Title: Timing of budset may save trees from earlier and greater intensity drought stress.

USDA Forest Service Research Area Emphasis 2014

Methods for integrating ground and remotely sensed data (co-author with C. Harrington)

Title: Does variable-density thinning create complex stand structures and alter vegetation community

USDA National Institute of Food and Agriculture 2012
Rangeland Research Program (co-author with R. Sheley)
Title: Matching physical safe-sites with seed traits to enhance seedling establishment on steep, rocky, and inaccessible landscapes

- The goals of this project are to develop the basic knowledge to match naturally occurring physical safe-sites with seed traits to maximize seedling establishment during restoration.

USDA National Institute of Food and Agriculture 2012
Agricultural and Natural Resources Science for Climate Variability and Change
New Investigator Research Grant (lead Project Director)

- The studied goal was develop management strategies of invasive trees (juniper) into sagebrush communities using grazing.

The Swedish Research Council - Formas
Assistant professor position 2010

The Swedish Research Council - Vetenskapsrådet
Junior research position 2010

Foundation Fund for Forestry Scientific Research
Research funding 2010
Awarded $60,000 Swedish kroner ($10,000 USD)
The Role of Fire on Regenerating Seedlings: An Ecophysiological Perspective

- The purpose of this study was to assess how short-term effects of fire and long-term absence of fire impacts forest regeneration.

Oscar and Lili Lamms Minne Foundation
Equipment and research 2009

Lars Hiertas Minne Foundation
Equipment and research 2009

Association of Forest Tree Breeding
Equipment and research 2009

National Science Foundation
PhD graduate research grant 2006

Awards, Honors and Fellowships

Wallenberg Foundation
Travel Grant 2010

School of Forest Ecology and Management
Travel Grant 2010

Idaho State University
Outstanding Doctoral Student of the Year 2009

Inland Northwest Resource Alliance

Graduate Fellowship, full tuition and stipend 2006-2008

National Science Foundation
GK-12 Fellowship, full tuition and stipend 2005-2006

Idaho State University
Teaching Assistantships 2004, 2008

Newington, Connecticut VA Hospital
American Heart Association Fellowship 1994

University of Connecticut
High School Apprenticeship 1993

State of Connecticut
First Place in State of Connecticut Biology Science Fair 1990

Field and Volunteer Work Experience

USDA Forest Service - Pacific Northwest Research Station California, Alaska, Oregon, USA
Forest Inventory and Analysis/ Forest Health and Monitoring
Forestry Technician, crew leader 2001 – 2004

- Used national protocols to inventory, identify and map vegetation and landscape characteristics of forests. Developed and conducted training programs. Planned daily, weekly, and monthly schedules to accomplish tasks, train new employees, and perform regular quality checks.

USDA Forest Service - Rocky Mountain Research Station Bonners Ferry, Idaho, USA
Biological Science Technician Jun-Aug 2003

- Established permanent mammal survey grids in remote forested sites across northern Idaho. Trapped, identified, marked and collected tissue samples from small mammals for DNA analysis.

US Geological Survey - Hawaii Volcano National Park Volcano, Hawaii, USA
Field Technician Mar-Jun 2003

- Set-up mosquito-trapping stations to assess mosquito diversity and abundance to determine risk and spread of avian malaria on the Hawaiian Islands. Maintained aviary, and cared for passerine birds.

The Nature Conservancy Portland, Oregon, USA
Volunteer Research Assistant 2000-2001

- Worked with an Americore team on invasive plant assessments along the Sandy River. Set-up monitoring protocols and estimated man-hours necessary for removal of noxious weeds.

Kenai Fjords National Park Seward, Alaska, USA
Student Conservation Association Park Ranger May-Aug 1998

- Developed and guided interpretive talks, and monitored and advised public on safety. Conducted Junior Ranger programs for youth.

University of Pennsylvania
Student volunteer 1995

- Visited high schools in Philadelphia to teach freshman and sophomore students about lead in drinking water and the dangers of lead poisoning.

Professional Associations

Ecological Society of America
Botanical Society of America
Society for Range Management
International Association of Landscape Ecology

Invited Peer Reviews

Functional Ecology, Oecologia, Forest Ecology and Management, PLOS ONE, Journal of Vegetation Science, Plant and Soil, Journal of Plant Ecology, Botanical Journal of Linnaean Society, Journal of Torrey Botany, Australian Journal of Botany, Ecological Research, Environmental Management, New Zealand Journal of Ecology, Journal of Agriculture and Crop Science , American Journal of Botany

Languages

English – Proficient; Hindi – Proficient; Spanish – Proficient; Swedish – Novice

Hobbies

Astronomy; Biking; Hiking

References

Dr. Constance A. Harrington — charrington@fs.fed.us
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Olympia, Washington USA 98512

Dr. Roger L. Sheley — roger.sheley@oregonstate.edu
Research Leader, USDA-Agricultural Research Service — +1 541 573 8901
Burns, Oregon USA 97720

Dr. Matthew Germino — mgermino@usgs.gov
Supervisor Research Ecologist, US Geological Survey — +1 208 426 3353
Boise, Idaho USA 83706

Dr. Marie-Charlotte Nilsson — Marie-Charlotte.Nilsson@slu.se
Professor of Forest Regeneration, Swedish University of Agricultural Sciences — +46 90 786 8440
Umeå, Sweden 90 183

Dr. David Wardle — David.Wardle@slu.se
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